INTELLIGENT ECONOMIES:
AI's transformation of industries and society

Contents

About this report

Artificial intelligence (AI) will profoundly affect the ways in which businesses and governments engage with consumers and citizens alike. From advances in genetic diagnostics to industrial automation, these widespread changes will have significant economic, social and civic implications. As such, *Intelligent Economies* explores the transformative potential of AI on markets and societies across the developed and developing worlds.

This report, developed by The Economist Intelligence Unit and sponsored by Microsoft, draws on a survey of more than 400 senior executives working in various industries, including financial services, healthcare and life sciences, manufacturing, retail and the public sector. Survey respondents operate in eight markets: France, Germany, Mexico, Poland, South Africa, Thailand, the UK and the US.

Additionally, we conducted in-depth interviews with business leaders and experts in AI. We would like to thank the following for their insights and contributions to the research:

- **Jeff Chen**, lecturer, Gordon Institute of Business Science, University of Pretoria

- **Alex Konnaris**, chief information officer, RMA Group

- **Juergen Maier**, chief executive officer, Siemens UK

- **JP Rangaswami**, chief data officer, Deutsche Bank

- **Daniel Ray**, director of data science, NHS Digital

- **Sandra Wachter**, research fellow, Oxford Internet Institute and Alan Turing Institute

Jessica Twentyman was the author of the report; Michael Hoffmann was the editor.

Executive summary

Artificial intelligence (AI) is moving from the realm of science fiction to real-world adoption among private- and public-sector organisations globally. Today AI is used by financial services companies to serve customers better and detect fraud; by healthcare providers to more accurately diagnose illness and identify more effective treatments; by manufacturers to keep machines up and running on the plant floor and to streamline supply chains; and by city authorities to track and mitigate urban challenges such as traffic, pollution and crime.

As AI becomes increasingly embedded in society, it will not only change the businesses that adopt it but also have significant economic, social and civic effects on citizens and consumers. In short, national and regional economies will become more intelligent in the ways they produce and distribute goods and services. But such transformations will also introduce new challenges. Indeed, policymakers, economists and technology stakeholders are observing these changes closely, often with commitments to protecting the rights of workers whose jobs may be replaced by automation.

Moreover, the adoption of AI is happening at a different pace from nation to nation and from region to region. Access and implementation of AI in different markets, in both advanced and emerging economies, will be determined by those countries' access to resources, capacity for innovation and the readiness of business and citizens to embrace the technology, as shown in this Economist Intelligence Unit report, sponsored by Microsoft.

The research is based on a survey of more than 400 business executives at organisations in eight key markets: France, Germany, Mexico, Poland, South Africa, Thailand, the UK and the US. Its aim is to help senior business and public-sector leaders understand the significant social potential of AI across industries and countries, with special attention devoted to the differences between advanced and emerging markets.

In particular, *Intelligent economies* explores to what extent corporate and government decision-makers believe AI will help meet their toughest challenges, including growth, productivity, innovation and job creation.

Key findings include:

Respondents are optimistic about the economic benefits that AI will bring. Over the next five years, survey respondents expect AI to have a positive impact on growth (90%), productivity (86%), innovation (84%) and job creation (69%) in their country and industry.

Both private- and public-sector organisations consider AI essential to business strategy. More than nine out of ten respondents (94%) describe AI as important to solving their organisations' strategic challenges, with 57% saying that it is "somewhat" important and a further 37% characterising it as "very" important.

The race to adopt and implement AI in business processes has already begun. More than one in four respondents (27%) say their organisations have already incorporated the technology into key processes and services, while another 46% have one or more AI pilot projects under way.

Despite their optimism, businessess recognise several major obstacles to leveraging AI successfully. When asked what major risks they see when adopting or increasing the use of AI, cost or financial risk tops the list, cited by 42% of respondents. Next is execution risk, with 36% saying their organisation may not have the necessary resources, in terms of people or tools, to effectively implement AI. Following closely behind are the workforce challenges involved in persuading employees to adopt new technology or learn new skills (35%) and security (32%).

CHAPTER 1:
The AI advantage

Artificial intelligence (AI) is on course to transform the global economy—and organisations around the world have high hopes for its potential, according to a new survey of more than 400 business executives and policymakers in both advanced and developing economies, conducted by The Economist Intelligence Unit and sponsored by Microsoft.

Over the next five years, survey respondents expect AI to have a positive impact on growth (90%), productivity (86%), innovation (84%) and job creation (69%) in their country or industry. In many cases, they believe the impact will be profound and sustained. For instance, more than three-quarters of respondents (77%) expect AI to improve the *sustainability* of economic growth.

Figure 1: The impact of AI on key economic indicators

How do you expect AI to improve each of the following areas of operations as they relate to your industry/country over the next five years?

% of respondents choosing "expect improvement"

Growth	90
Productivity	86
Innovation	84
Job creation	69

As Juergen Maier, chief executive officer of Siemens UK, puts it: "AI and machine learning are important aspects of a wider trend of digitalisation that promises nothing less than a fourth industrial revolution. I'm a pragmatist at heart, so I don't make that claim lightly. The innovation opportunity is huge and with it will come productivity and prosperity, if it's handled right."

A 2017 study conducted by global management consultancy firm PwC suggests that there are reasonable grounds for such optimism. The firm calculates that global GDP will be 14% higher by 2030 as a result of AI adoption, contributing an additional US$15.7trn to the global economy. That's more than the current output of China and India combined.[1]

The same report finds that productivity improvements are expected to account for more than a third of that economic gain (US$6.6trn), as organisations seek to augment the productivity of their human workforce with AI technologies and to completely automate some tasks and roles.[2]

For example, in healthcare, AI-powered diagnostics might use a patient's medical history or genetic make-up as a baseline against which small deviations might serve as a sign of a possible illness—but further investigation and exploration of treatment options would still be up to that patient's physician.

Likewise, in insurance, the work of processing low-value claims might be handed to a machine capable of applying basic, predefined rules to determine which should be approved. Claims that don't seem to fit those rules, however, might be passed to a human colleague for further investigation.

On top of this, we are likely to see the emergence of new jobs that would not have existed in a world without AI: companies will need to recruit programmers, data scientists and robotics engineers.

The term "artificial intelligence" can be tricky to define. Broadly speaking, AI refers to software capable of analysing large quantities of data, learning from the results of such assessments and using this knowledge to refine future processes and systems.

All this is made possible by the recent explosion of digital data and almost-ubiquitous access to low-cost processing power. This widespread digital transformation of business and society enables machines to use powerful algorithms to perform tasks that previously required human intelligence, such as rules-based decision-making, visual perception and speech recognition.

In many cases, machines can perform these tasks faster and with a higher degree of accuracy than human workers.

Tackling strategic challenges head-on

There's no doubt that businesses today operate in uncertain geopolitical and economic times. The good news is that in 2017 the global economy recorded its best performance in six years and looks set for sustained growth in 2018. The Economist Intelligence Unit, for example, expects global growth of 3.8%, surpassing 2017's growth rate of 3.7% and well above 2016's 3.2%.[3]

But one of the biggest challenges, particularly for companies in advanced economies, is that the two traditional levers of production—capital investment and labour—no longer reap the same returns as in previous decades. In other words, in order to increase output and boost revenue, business leaders have been accustomed to investing in new equipment and hiring more workers. These days, such actions have only a muted positive impact in wider economic terms. Business leaders must therefore find ways to open up new sources of value and growth, and AI technologies could be one way to achieve such goals.

Survey respondents agree. More than nine out of ten (94%) describe AI as important to solving their organisations' strategic challenges, with 57% saying that it is "somewhat" important and a further 37% characterising it as "very" important.

When asked what these strategic challenges are, respondents in the private sector place cyber-security (25%) at the top of the list, closely followed by economic uncertainty (20%) and new customer acquisition (18%). Public-sector respondents meanwhile identify modernising IT (26%) and economic uncertainty (25%) as their top strategic challenges.

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Juergen Maier, CEO of Siemens UK

Footnote:

3. Global Forecasting Service The EIU, April 2018 http://gfs.eiu.com/Article.aspx?articleType=gef&articleId=526630836&secID=0

Figure 2: Businesses' top strategic challenges today

% of respondents

Private sector		Public sector	
Cyber-security	25	Modernising IT	26
Economic uncertainty	20	Economic uncertainty	25
New customer acquisition	18	Reputation and/or brand protection	17
Talent and skills	17	Improving public service delivery	17
Modernising IT	17	Measuring performace	14
Measuring performace	15	Cyber-security	13
Regulation and compliance	13	Engaging citizens	13
Business model sustainability	13	Talent and skills	12
Data governance	12	Fiscal constraints	11
Reputation and/or brand protection	11	Regulation and compliance	9
Engaging consumers	11	Data governance	9
		Stakeholder expectations	5

Across advanced and developing economies, these challenges differ. Measuring performance, for example, is seen as a strategic challenge by 26% of all respondents in advanced economies but by only 4% in developing economies. Economic uncertainty, meanwhile, is perceived as a challenge by only 7% of developing economy respondents, but more than a third (35%) of those in developing economies.

Economic uncertainty is no reason not to explore AI, says Mr Maier. "In any economy, there will always be those companies that see uncertainty as an excuse not to invest in new technologies or to be overly wary of risk. The better mindset is that this economic uncertainty provides all the more reason to get ahead of the game."

Despite the many challenges involved, business leaders remain optimistic that AI will improve many areas of their business in the years to come. Respondents believe it will help them with process innovation (89%), talent attraction and retention (85%) and product innovation (84%), either somewhat or a great deal. In the private sector, AI will help them improve customer services (80%). In the public sector, it will help with citizen engagement (73%).

Aside from the advantages to their own organisations, executives see big advantages for their countries and industries. Respondents expect AI to boost output per worker (76%), for example, and demand for products and services (70%) in their respective markets.

CHAPTER 2:
Companies get smart about AI

The race to adopt, implement and derive social and economic value from AI has begun. Over one in four respondents (27%) say that their organisations have already incorporated the technology into key processes and services, while 46% have one or more AI pilot projects under way. A mere 6% say that their organisations have not adopted AI and have no plans to.

Across all sectors included in the survey, AI technologies most frequently used include image analysis (35%), virtual assistants (31%), predictive analytics (29%), machine learning (28%) and natural language processing (26%).

Figure 3: Most frequently used AI technologies today

% of respondents

Technology	%
Image analysis	35
Virtual assistants	31
Predictive analytics	29
Machine learning	28
Natural language processing	26
Self-driving technologies	16
Robotics	16
None, organisation does not use AI	27
Don't know	1
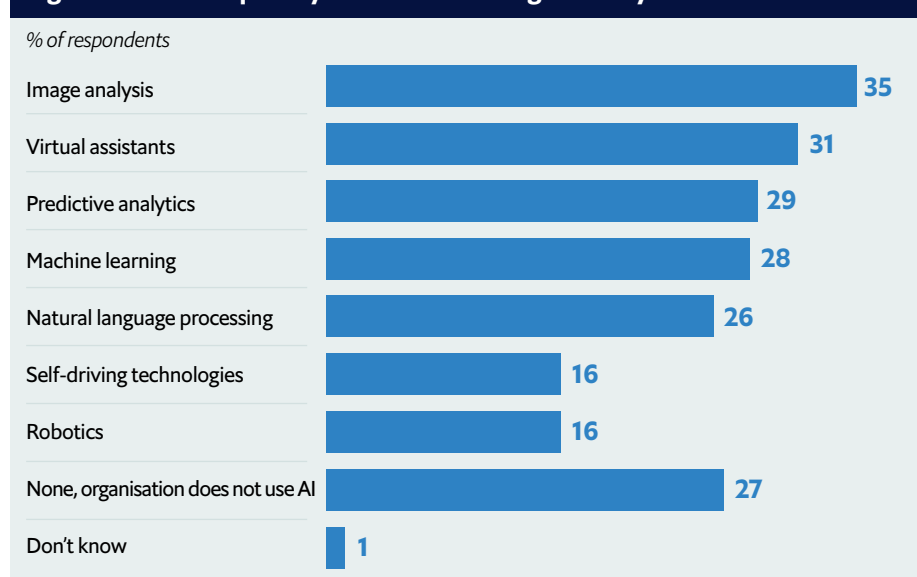
What is clear is that different AI technologies are finding favour in particular sectors, according to specific industry needs. In March 2018, for example, Bank of America's head of digital banking, Michelle Moore, used social media site Twitter to introduce customers in Rhode Island to a new colleague, Erica.

Erica is a virtual assistant or chatbot, accessible via the Bank of America mobile app, which uses natural language processing to help customers with routine tasks such as scheduling payments or looking up account balances and recent transactions, via voice commands. The company expects to introduce Erica to other US states in 2018.

Erica is not alone. Today many other banks have put AI-powered virtual assistants to work. There's Capital One's Eno; Progressive's Flo; Orange Bank's Djingo in France; and Amy at HSBC in Hong Kong. These virtual assistants automate tasks previously conducted by customer service teams to answer clients' most routine questions, thereby freeing up human call centre agents to handle more complex issues.

As AI technology becomes more sophisticated, virtual assistants will probably learn to take on even more complex tasks and work alongside their human colleagues. Chatbots may assist humans during customer calls by prompting them to ask the right questions and by providing them with relevant information such as customer data or product summaries.

It is no surprise, then, that in the survey, financial services respondents report particularly high levels of virtual assistant adoption (48%), but they're also using predictive analytics (38%) and machine learning (36%). Predictive analytics can be extremely useful in reducing the risk of loan defaults, while machine learning can help identify patterns of transactions that might indicate fraudulent activity.

Indeed, JP Rangaswami, chief data officer of Deutsche Bank, notes that the financial services industry first began exploring AI technology for tasks like fraud prevention and improving operational processes. For these activities, the industry already had structures in place for understanding data sets and looking for patterns, so this was a natural place to start applying AI opportunities. With the next generation of AI and advances in natural language processing, tools like virtual assistants became possible.

Daniel Ray, director of data at NHS Digital, which provides information, data and IT systems to the National Health Service (NHS) in England also describes a similar trend of companies evolving their approach to AI over time. In the healthcare industry, for example, "the use of AI will start small, focusing on diagnosing specific diseases and uncontroversial areas like helping with administrative tasks. Eventually, advances in AI will leave the clinical workforce free to focus on and solve more challenging problems like high-complexity diagnostics."

The public sector, meanwhile, has particularly high levels of machine learning adoption (34%), perhaps because of its commitment to make smart cities cleaner and safer and to help municipalities predict levels of traffic, pollution and crime. That said, most respondents expect AI-driven innovation in their country and industry over the next five years to be led by the private sector (47%), though 41% indicate that they expect it to be distributed equally in the private and public sectors.

AI: A work in progress

Five years from now, respondents expect to use or increase those same AI applications with similar frequencies, although machine learning takes the top spot by a slim margin.

Those in manufacturing have particularly high expectations for the use of robotics (36%). For decades, industrial robots were typically expensive and bulky, putting them out of reach of small and medium-sized manufacturers with limited budget or space on the factory floor. In recent years, however, smaller and far cheaper models have emerged, often referred to as "collaborative robots", or cobots.

The name derives from the fact that, unlike traditional robots kept in cages or behind safety screens, cobots can work safely alongside human colleagues, thanks to sensors that help avoid collisions. Cobots can also be programmed to perform a wide variety of tasks, making them a far more attractive option for manufacturing companies of all sizes.

"From steam power to mechanisation, industrial transformation has been driven by technology and resulted in increased output and increased employment," argues Mr Maier of Siemens UK. "Robots, to me, are no different and can actually benefit workers by taking over jobs that humans perform today that can be difficult, repetitive and sometimes even dangerous."

A report last year from research company ARK suggests that by 2025 the price of industrial robots will drop by 65%. "Combined with advances in machine learning and computer vision, this drop in costs should cause an inflection point in the demand for robots as they infiltrate new industries with more provocative use cases," says ARK analyst Sam Korus.[4]

Predictive analytics is the number-one AI use case that respondents feel has or will become relevant to their industry, cited by more than one in four respondents (26%). This involves the use of statistical algorithms to identify the likelihood of future outcomes: when is a delivery truck likely to break down, for example, and when might it hit traffic congestion or poor weather conditions, causing delays?

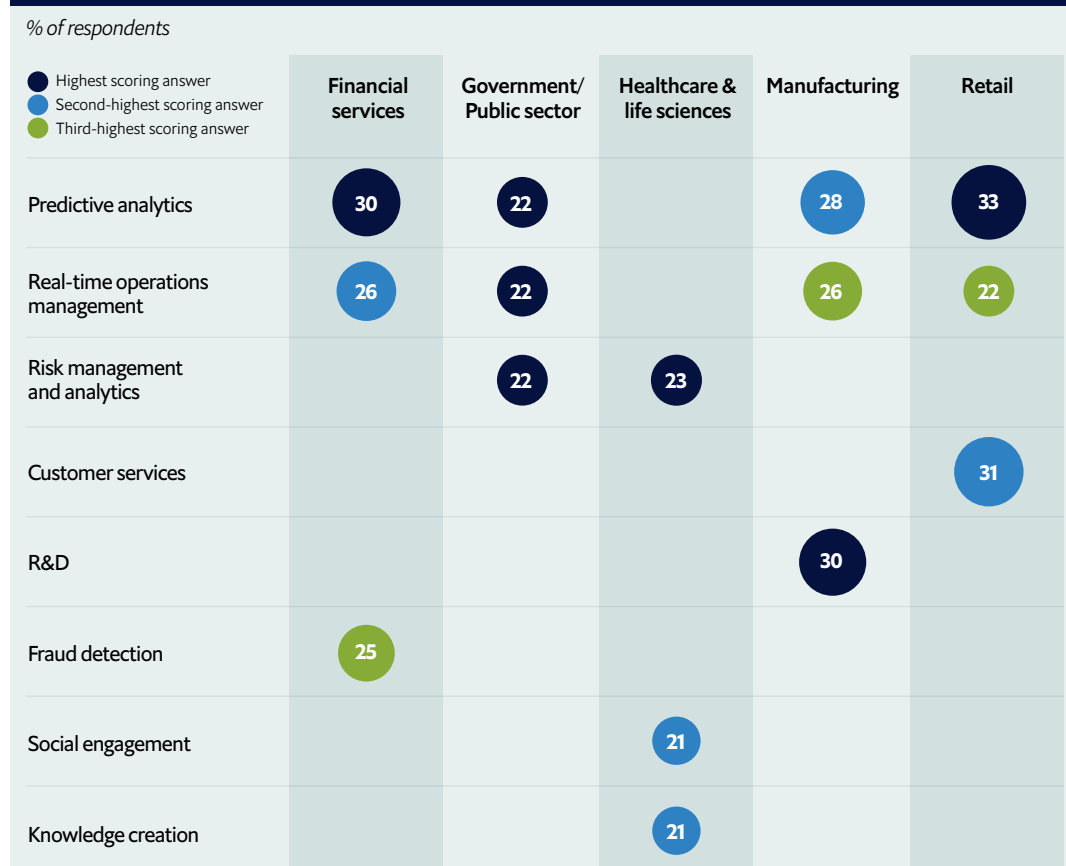## Figure 4: Top AI use cases

% of respondents

Use case	%
Predictive analytics (eg, demand and inventory forecasting, predictive maintenance)	26
Real-time operations management (eg, improved internal efficiencies)	23
Customer services	21
Risk management and analytics	20
Customer insight	18
Customer experience (eg, personalisation)	17
Research and development	17
Supply chain, procurement or logistics optimisation	17
Human resources	16
Fraud detection (eg, financial crime prevention)	16
Knowledge creation	16
Pricing and promotion	13
Social engagement	12

Figure 5: Top three AI use cases by industry

% of respondents

- ● Highest scoring answer
- ● Second-highest scoring answer
- ● Third-highest scoring answer

	Financial services	Government/ Public sector	Healthcare & life sciences	Manufacturing	Retail
Predictive analytics	30	22		28	33
Real-time operations management	26	22		26	22
Risk management and analytics		22	23		
Customer services					31
R&D				30	
Fraud detection	25				
Social engagement			21		
Knowledge creation			21		

"In engineering and manufacturing, for example, it might be a question of improving the efficiency of production lines or better managing equipment and failure detection," says Alex Konnaris, CIO at RMA Group, a Bangkok-based engineering services and retail company. "In supply chain operations, it could be a way to select alternative transportation routes or make the movement of inventory and the loading of containers more efficient."

But from an industry perspective, the primary use cases differ by sector. Retail respondents, for example, are more likely to mention customer service (cited by 31%, compared with a cross-survey average of 21%), while financial services respondents more frequently cite fraud detection than the average (25% versus 16%).

At every stage in the AI journey, the CIO/CTO take the lead. They propose which AI applications to develop, sign off on them, manage implementation and monitor customer and user reactions. But at every step, they are supported by the head of IT and other members of the C-suite, especially the CEO.

Mr Konnaris of RMA Group notes, "As with any organisation-wide systems, the best strategy is 'start small, think big', as there will be a need for scalable and adaptable systems." IT leaders have an important role to play here, he agrees, as "the business may not be ready to drive such a project or have any idea about the key performance indicators they are interested in achieving."

IT should thus choose one or more C-level partners with whom to collaborate – for example, the CFO – to identify potential return on investment by finding some "quick wins", Mr Konnaris advises. "Only then will the organisation be ready to tackle some of the more challenging areas of the business," he says.

CHAPTER 3:
AI without borders

One thing is clear: AI is making its mark in both advanced and emerging economies. To dismiss emerging markets as too lacking in financial resources and technical skills to take advantage of the technology is to miss the wider evidence. Technology companies are investing heavily and setting up AI research labs around the world—and not just Silicon Valley's tech giants but also Indian and Chinese companies like Paytm, Alibaba, Baidu and Tencent.

In other words, confidence in AI's social and economic impact is a global phenomenon. From Shanghai to Toronto and Tel Aviv, AI hubs will likely help drive growth of local economies. Indeed, when it comes to economic competitiveness, developing economies are significantly more bullish about the positive effects of AI, with 83% of them expecting an increase, compared with just six out of ten respondents in advanced economies.

That's not to say, however, that AI will not pose challenges for many developing economies, since it could disrupt some tried-and-tested models for competing on the world stage.

Many of the most successful developing economies, such as India and China, have been able to leverage their low-cost human workforces in order to offer manufacturing and business services to companies in advanced economies and thus participate in global value chains. Notable examples can be found in areas such as garment manufacturing, call centres and business process outsourcing.

The business of providing outsourced services at a lower cost in emerging markets could become problematic as businesses in advanced economies adopt AI at much faster rates and find new ways to get the same work done in their home countries, by machines, more quickly and at an even lower cost. Take, for example, call centres. Banks in advanced economies may be less inclined to outsource these jobs if they can successfully deploy automated assistants as the first line of contact for their customers.

For businesses outside of the technology sector and located in emerging markets, the adoption of AI is still a step into a very new world. Unsurprisingly, then, the survey finds that advanced economies have more frequently adopted AI compared with developing economies (84% v 63%). Developing economies are understandably more concerned about the cost and financial risk associated with implementing AI (47% v 36%).

Mr Konnaris of RMA Group in Thailand notes: "The 'start small, think big' strategy can be very difficult for large organisations in developing economies, as the cost of 'starting small' can still be significant. Organisations can be slow, for example, to adopt new technologies because of the costs and changes in management risks. Often, they will adopt home-grown solutions in the hope that they will reduce costs and risks, but it can still be challenging to gain access to enough quality information to start making use of AI."

Confidence in AI's social and economic impact is a global phenomenon.

In other words, even where developing economy organisations have invested in modernising their IT infrastructure, they may not have progressed far enough yet to reach the optimum level of technological sophistication required for AI's desired benefits.

South Africa is arguably better positioned than many other developing economies to leverage new technologies in its most competitive industries, with its wealth of exportable natural resources like minerals, metals, diamonds and gold, as well as its strong banking sector. Many businesses in these sectors recognise the potential benefits of AI and automation, says Dr Jeff Chen of the Gordon Institute of Business Science at the University of Pretoria. But he still sees challenges ahead.

"In South Africa, I see many business leaders talking about AI, but saying and doing are two different things. I'm not convinced many companies here have a serious strategic roadmap for AI at this point," he says.

A number of barriers stand in the way: poor or non-existent internet infrastructure in many parts of the country; the quality of education provided to many of the nation's citizens; and a negative stigma around automation because of stubbornly high unemployment rates that date back decades.

All these issues will need tackling if South Africa is to reap the benefits of AI. A recent report co-authored by Dr Chen and a team from Accenture calculated that AI, if implemented well, could add an entire percentage point to expectations of annual economic growth in South Africa by 2035, from 3.5% to 4.5%.[5]

Still, Dr Chen is optimistic that business leaders and policymakers will be able to work together to address these challenges and pave the way for greater automation. "South African companies want to compete, and there's a political will here for them to succeed. There's a shared understanding now that AI will help us leapfrog the global competition in terms of digital transformation, but only if we get the ingredients right."

In the UK, meanwhile, productivity needs an urgent boost if the country is to thrive in the post-Brexit era. AI, along with other digital technologies, has a big role to play, according to Mr Maier of Siemens UK. In 2017 he was appointed by the UK government to lead an independent review of industrial digitalisation, the Made Smarter Review, setting out how UK manufacturing might be transformed by the adoption of industrial digital technology.

Mr Maier believes that industry and government must work together to upskill workforces in the UK and unlock the benefits of digitalisation. "It's going to take a massive rethink and a radical shift in economic and education policy," he says. However, he adds, digitalisation could do a great deal to tackle Britain's balance-of-payments problem, whereby it imports a great deal more than it exports. In other words, the UK economy of the future needs to be based more on making and exporting more products and services than it does today.

"For UK manufacturing, new digital technologies are both a big threat and a huge opportunity. The threat for business leaders is that if you don't get in the race, you could be left behind. You'll be at a profound competitive disadvantage. The opportunity, however, is that if you embrace these technologies, you could do a great deal to optimise operations, reduce costs and increase productivity."

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Mr Maier, chief executive officer, Siemens UK

Footnote:

5. Artificial intelligence: Is South Africa Ready? Accenture. https://www.accenture.com/t20170810T154838Z__w__/za-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Local/za-en/Accenture-AI-South-Africa-Ready.pdf

And this potential is not limited to manufacturing. In a speech given in May, the UK's prime minister, Theresa May, called for "a whole new industry around AI in healthcare" in Britain, and pledged to support the technology's adoption within the NHS, on the basis that using it to diagnose prostate, ovarian, lung and bowel cancer at an early stage might reduce deaths by about 10% within 15 years.

"Late diagnosis of otherwise treatable illnesses is one of the biggest causes of avoidable deaths," said Ms May, adding, "And the development of smart technologies to analyse great quantities of data quickly and with a higher degree of accuracy than is possible by human beings opens up a whole new field of medical research and gives us a new weapon in our armoury in the fight against disease."

Accordingly, if the UK can address its skills issue, Mr Maier suggests, "then rather than worry about whether our jobs will be replaced by robots, we can focus on making sure industry has the designers, developers and engineers it needs for economic success."

CHAPTER 4:
AI challenges, AI risks

All new investments, especially when they involve previously untested technologies, involve some degree of risk for organisations.

In this respect, AI is no different; when asked what major risks executives see when adopting or increasing their use of AI, cost or financial risk (42%) tops the list. Next is execution risk, with 36% saying their organisation may not have the resources, in terms of people or tools, to effectively implement AI. Closely behind are the workforce challenges involved in persuading employees to adopt new technology or learn new skills (35%) and security (32%).

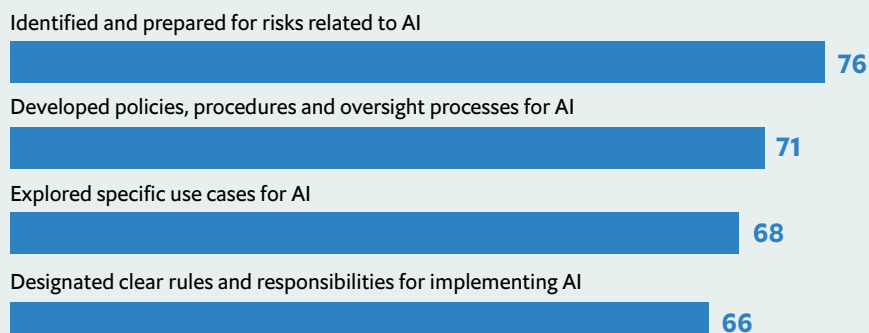## Figure 6: Risks to adopting or increasing use of AI

% of respondents

Cost or financial risk	42
Execution risk (eg, organisation doesn't have resources, in terms of people or tools, to effectively implement AI)	36
Workforce challenges (eg, employee reluctance to adopt new technology or learn new skills)	35
Security	32
Macroeconomic uncertainty	23
Benefits not as great as expected	18
Reputation damage	13

Figure 7: Preparing for AI transformation

To what extent has your organisation done each of the following?

% of respondents choosing "done more"

Identified and prepared for risks related to AI	76
Developed policies, procedures and oversight processes for AI	71
Explored specific use cases for AI	68
Designated clear rules and responsibilities for implementing AI	66

Still, companies seek to mitigate those risks, with more than three-quarters (76%) saying they have identified and prepared for risks related to AI and 71% saying they have developed policies, procedures and oversight for AI.

The risk of job displacement, in particular, is an issue that receives large amounts of attention. Whether or not robots will replace human workers is an important question. However, arguably less attention is paid to the issue of job replacement or the prospect of new kinds of employment emerging to support machines in their work.

Even in the short-term, opportunities abound for employees with the right skills. As Mr Konnaris at RMA Group explains, there's a big need worldwide for people who are skilled at organising data and drawing insight from it. "We are moving from a focus on data entry to a focus on data analysis," he says. "The number of people may not change, but there will be a need for different skills."

Mr Rangaswami points to past innovations in technology as historical precedents for what may happen with AI: "Every advancing wave of technology or successful industrial revolution tends to create a commoditisation of past roles. This leaves workers with more freedom to use human intelligence in emerging roles. So while some roles and tasks will be replaced by AI, others will emerge."

Additionally, the evolution from data wrangling to data science and advanced analytics is an important transition. With the advent of AI, machines will be able to process large volumes of data that previously would lie dormant. If analytic systems can be tuned correctly, data-savvy humans will have access to an unprecedented wealth of information from which to draw conclusions and make smarter decisions.

Despite these often-expressed concerns about job displacement, survey respondents seem broadly optimistic that AI will create new roles. Overall, nearly six out of ten (59%) believe that AI will increase wages and 56% actually see a boost to the employment rate in their country or industry.

Mr Maier at Siemens says: "We need, as business leaders, to be smart about this and more pragmatic than some of the scary headlines we see. Done right, digital technologies like AI can open up employment opportunities, and it's that we need to be focusing on. The world will need developers, programmers and engineers in huge numbers, and these jobs will provide many people with interesting, well-paid work."

In general, many executives are optimistic that humans and AI can partner together to produce social and economic benefits that satisfy businesses, employees, consumers and citizens alike. Indeed, AI may operate most effectively when it augments human intelligence and ingenuity to solve today's societal challenges, from curing illness with advances in personal genomics to manufacturing safer, driver-less cars.

At the same time, business leaders need to be aware of the wider societal impact that could result by delegating decisions to machines, says Dr Sandra Wachter, a lawyer and research fellow in data ethics at the Oxford Internet Institute at the University of Oxford and the Alan Turing Institute in London. She agrees that AI algorithms can certainly be more efficient, less expensive and more accurate than humans.

"But they can also be highly complex and opaque," she adds, explaining that an organisation that deploys AI may not fully understand the decisions that an algorithm arrives at, whether that's approving a customer for a loan or helping to process a job application.

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> *Mr Konnaris, chief information officer, RMA Group*

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>
> *Mr Rangaswami, chief data officer, Deutsche Bank*

In other words, there's a risk of machines making biased and potentially discriminatory decisions on behalf of the companies for which they work. "Companies need to understand the decisions that algorithms make and the potential these have on customers or citizens, as well as on society as a whole," says Dr Wachter. "For every technology, we need to negate the potential risks associated with them and with AI, that's not always as transparent or explainable as it might be."

In the EU, the new General Data Protection Regulation (GDPR) seeks to create transparency rights and safeguards against automated decision-making—a point that companies managing the data of EU residents will need to bear in mind.

In particular, says Dr Wachter, Article 22 of the GDPR grants individuals the right to contest a completely automated decision if it has legal or other significant effects on them. The GDPR also requires companies to inform customers about the general functionality of an automated system when decisions are made using those data. By contrast, she adds, other jurisdictions, most notably the US, believe in a more "soft-touch, self-regulatory" approach.

The importance of regulation, governance models and ethical frameworks will only continue to grow. In healthcare, for instance, Prof Ray suggests that AI be treated almost similar to a drug trial or the revalidation of a medical professional. The industry must ask, "Is the algorithm doing what it was originally intended to? And if AI is invovled in treatment decisions, what is the bar of acceptability we're willing to accept from a computer?"

Today, more than two-thirds of survey respondents indicate that their organisation's adoption of AI was either somewhat (44%) or strongly (23%) regulated. However, since the regulatory requirements with which organisations are expected to comply are likely to shift in the light of new rules such as GDPR and scandals like those that have engulfed Facebook and Cambridge Analytica, it's clear that much work will be needed to stay abreast of current thinking on these issues. Business leaders will need to understand the outputs of their algorithms' decision-making.

Mr Rangaswami of Deutsche Bank notes that the evolution of AI from single use cases to widespread implementation will ultimately require three necessary steps, the latter two of which emphasise both regulatory and ethical considerations, as well as proper training.

"The first stage is building data infrastructure, which many businesses have already begun to focus on. The second step is building the relevant entitlement, privacy and confidentiality protection models that address regulatory and ethical concerns. And the third piece is education to help the end-user become familiar with using such powerful tools," he says.

And, as Mr Rangaswami suggests, even when businesses feel they have addressed the risks, there will still be practical barriers to overcome. Respondents believe that a lack of technical knowledge or skills may be the greatest impediment (cited by 29%) to implementing AI, followed by security concerns (24%) and lack of insight into what end-users want (23%).

According to Mr Konnaris of RMA Group, implementation hurdles are just the start of the challenges ahead for AI adopters. "It's also about having access to enough quality information, followed by the ability to analyse and interpret results in meaningful ways."

> **"Companies need to understand the decisions that algorithms make and the potential these have on customers or citizens, as well as on society as a whole."**
>
> *Sandra Wachter, research fellow, Oxford Internet Institute and Alan Turing Institute*

In addition to quality information, Prof Ray also notes the importance of stakeholder trust in AI to strengthen momentum from an industry perspective: "Maintaining trust with patients will be really important. The last thing we want is to scare anybody, but if we can make sure that the technology is explained to patients in the right way, then we can build a positive springboard for healthcare."

Even with all that in place, though, organisations must settle on an accurate and meaningful way to measure the success of their AI applications. This is a complex area, as key performance indicators (KPIs) must be tailored according to the business outcome that an AI application is intended to deliver: is it faster processing of invoices, less downtime for plant floor machinery, quicker resolution of customer queries, for example. And given the ability of many AI applications to learn from data and refine their responses, it will be necessary to consistently assess how those KPIs can improve over time.

"Everybody must ask, 'how is this creating customer value?' Because even metrics that don't appear to improve the customer experience, like cost reduction or risk management, should all be driven by an assessment of how they could improve customers' lives. We must consider how these benefits can be passed on."

Mr Rangaswami, chief data officer, Deutsche Bank

Figure 8: Metrics to evaluate the success of AI applications

% of respondents

Quality	36
Achieving expected return on investment (ROI)	32
Customer and/or stakeholder satisfaction	31
Contribution to strategic goals	30
Execution delivery (on time and on budget)	27
Customer and/or stakeholder use	25
Don't have established metrics to assess AI	14
No metrics have been in use long enough to assess	8

Today, quality is the most common measure of AI success used by survey respondents, cited by 36%. That's followed by achieving expected return on investment and customer/stakeholder satisfaction (31%). But 14% admit they don't have established metrics by which to measure success.

Mr Rangaswami of Deutsche Bank says that AI-related metrics should focus on the customer: "Everybody must ask, 'how is this creating customer value?' Because even metrics that don't appear to improve the customer experience, like cost reduction or risk management, should all be driven by an assessment of how they could improve customers' lives. We must consider how these benefits can be passed on."

CONCLUSION:
Transformational possibilities ahead

As AI emerges from research labs and IT back offices and into the mainstream, and humans and machines begin to collaborate more closely, the transformational possibilities of AI for both businesses and societies are enormous.

Some industries, markets and individual companies are further down that road than others, but few will be left untouched. For now, it's still early days, and there are many opportunities for all. Intelligent economies, after all, will be made up of smarter businesses, and regardless of size or geographic location, every organisation has the opportunity to leapfrog the competition. Those that are successful will probably prioritise the following approaches:

Experimentation: an approach based on identifying small early wins will lay the groundwork in terms of innovation and risk mitigation strategies for more ambitious deployments in future. Organisations will look to AI to help them better understand the needs of customers and citizens and then develop new products, services and business models that are more resilient to future economic uncertainty and competitive disruption.

Skilling up: a workforce that clearly understands the benefits that AI brings to their jobs and is equipped with the skills to use this technology to best effect will be well positioned to identify fresh opportunities, not just for increased productivity but also for personal career development. Smart employers will gear training and development accordingly.

Governance: organisations in both the private and public sector will build in appropriate governance and control mechanisms that evaluate the societal impacts of AI. They will pay particular attention to building trust in their AI solutions and ensure that the logic underpinning their algorithms is sound, unbiased and can be easily explained to customers, employees and regulators.

In these ways, business leaders can make their own contribution to building tomorrow's intelligent economies, not just for their own benefit, but for that of their workforce and society at large.